

EIM Services

Thor Design Panel 2/3

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Version 2.0

EIM Services Software Requirements and Design Specification

EIM and Application Interface Thread

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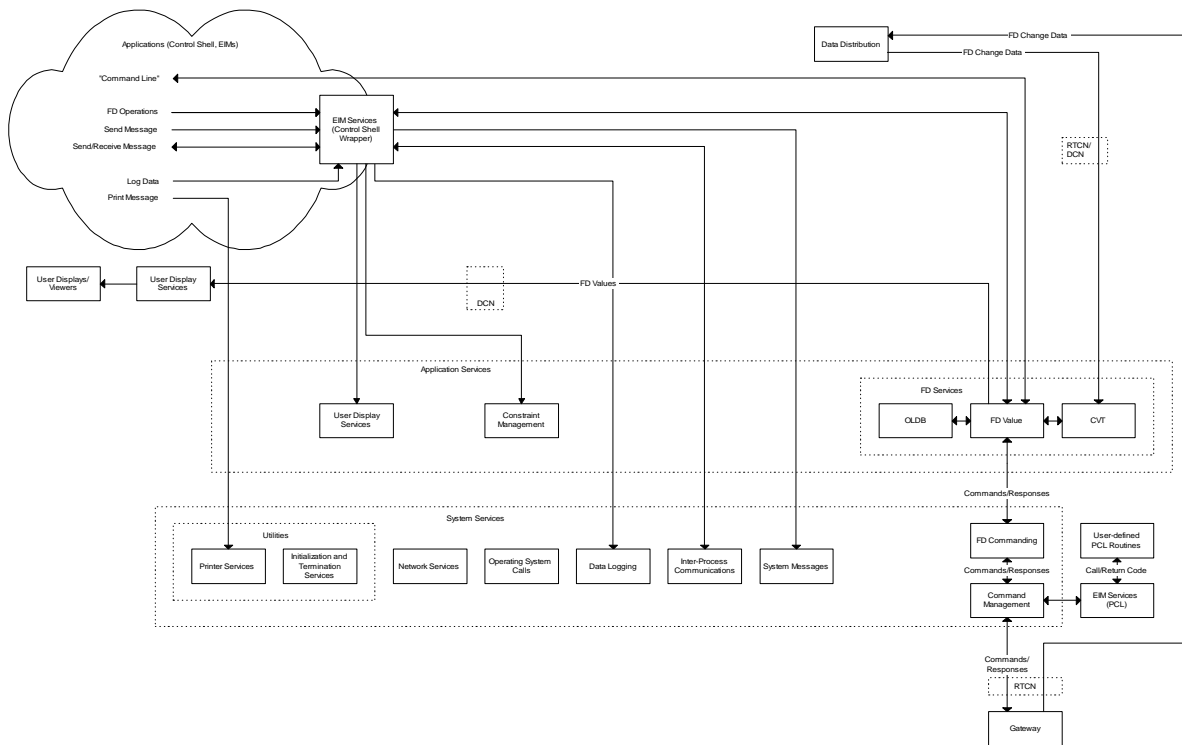
1. EIM Services

1.1 EIM Services Introduction

1.1.1 EIM Services Overview

The EIM Services CSC provides wrappers for EIMs to communicate with other Application Services on the RTPS. The wrappers provide an interface to data logging, system messages, FD Services, constraint management and other systems and services required by the EIMs. EIM Services reside on the CCP within the scope of the EIM in Control Shell application development CASE tool. EIM Services provide Control Shell Atomic Components (ATCs) which simplify the design and implementation of EIMs. EIM Services ATCs bring the Application Services into the visual framework of Control Shell, thus allowing the EIM designers to concentrate on the design and not the implementation details. A repository of ATCs will provide all the required RTPS functions needed by all EIMs.

End Item Management Services is a collection of ATCs that encapsulate Application Service's APIs providing an interface between User EIM Applications and Application Services. This protects applications from any changes in the underlying Application Services interface, as well as protecting application services from changes in user application tools. Subsequent adaptations to Application Services can thus be accommodated through EIM Services without altering the applications themselves.



1.1.2 EIM Services Operational Description

The EIM Services CSC shall provide ATCs for the EIM to communicate with Application Services on the CCP. Commands originating in the CCWS will interface with the EIM through CORBA. The EIM will provide control and monitoring with Finite State Machines (FSMs) and Composite Object Groups (COGs). COGS and FSMs will contain EIM Service's ATCs for interfacing with Application Services. EIM Services shall call the API's to update FD values, send FD commands, log data, set Constraints, display dialog windows, and send System

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Messages. EIM Services shall use CORBA to receive stimuli and commands from other applications, receive Constraint Notifications and for other inter-process communication.

1.2 EIM Services Specifications

1.2.1 EIM Services Groundrules

- Not all Applications Services API's or FD types will be provided in Thor
- The ATCs are only a thin wrapper interface and will simply pass on any Application Service's return codes, errors or exceptions back to the calling End Item Manager application.
- EIM Services makes no distinction between pseudo FD's, Fused FD's and real FD's.
- EIM Services will not include:
 - Support to receive Constraint Notification Historical Event Messages
- EIM Services expects to be provided:
 - FD Services: API and User Guide
 - Data Logging: API and USER Guide
 - System Messages: API and USER Guide
 - EIM App Software: Requirements, Priorities
 - Constraint Management Services API and User Guide
 - Control Shell: Licenses, Training, Beta Release

1.2.2 EIM Services Functional Requirements

SLS Requirements

- (SLS 2.2.5.1.3) The RTPS shall provide a layered technique for defining End-Item monitoring and control that supports reuse and reduction of time to implement.
- (SLS 2.2.5.4) Constraint Management
- (SLS 2.2.5.4.2) CLCS shall provide the capability for multiple (TBD number) users and system or user applications to request notification of constraint events for each Measurement FD.
- (SLS 2.2.5.4.3) CLCS shall provide the capability for each user, and system or user application requesting constraint notification to specify the limits/condition under which they will be notified.
- (SLS 2.2.5.6.3) RTPS shall provide the capability to delegate continuous End-Item monitoring to Constraint Management and respond to Constraint Management notification events.
- (SLS 2.2.5.6.8) RTPS shall provide an End-Item control layer/encapsulation allowing maintenance in a single place and reuse through out user applications.

Miscellaneous System Services:

- (SLS 2.2.10.1.16) The CLCS shall provide the capability for System and User Applications to record data to the SDC.
- (SLS 2.2.10.1.17) The RTPS shall provide the capability to System and User Applications to record limited messages on the local computer's hard file storage device.

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Derived Requirements

- EIM Services will provide Control Shell ATC interfaces for FD Services API's per CLCS FD Services Interface Agreement (KSC-84K00362): (A complete list of Application Service's APIs is in Appendix)
 - FD Read
 - FD Write
 - FD Multiple sample queued read
 - OLDB read
 - Data Fusion Algorithm Read
 - Data Health Algorithm Read
 - PCL Algorithm Read
- EIM Services will provide each FD type: (Thor minimum)
 - Discretes
 - ON_OFF
 - Analogs
 - AMPAC
 - AMP
 - DEGF
 - DEG
 - GAL_MIN
 - MAMP
 - PCT
 - PSIA
 - PSID
 - PSIG
 - VAC
 - V
- EIM Services will for each FD type provide an ATC :
 - FD Read only
 - FD Write only
 - FD Read and Write
 - FD Queued Read
- EIM Services will provide two Control Shell repositories:
 - A development repository
 - A user repository (Configuration controlled).
- Application Development will provide test End Item Managers to test all the EIM services ATCs. Test EIMs will be used later for regression testing.

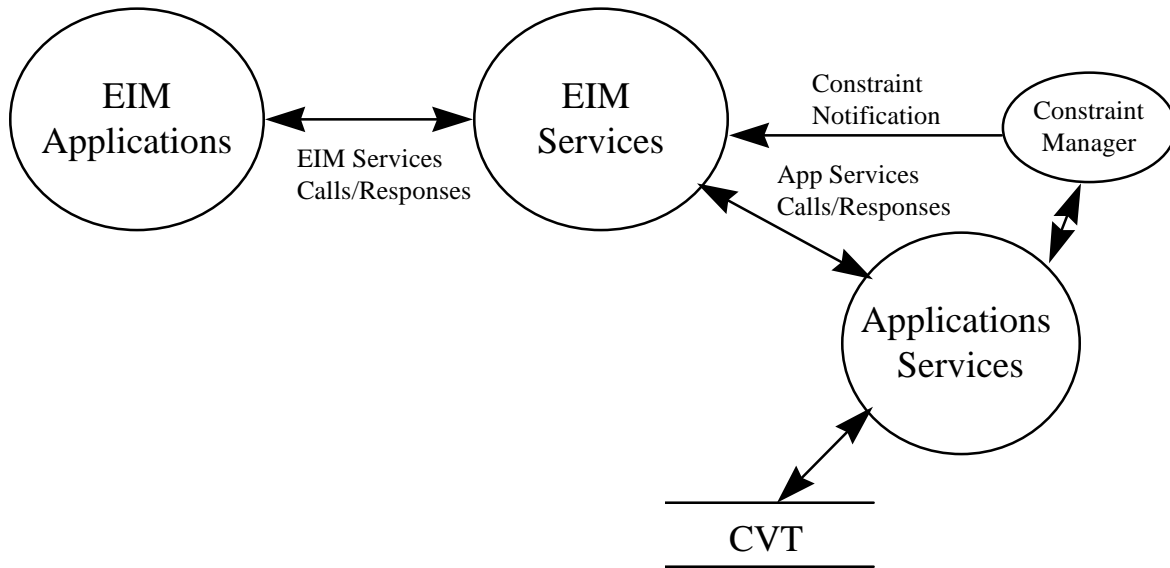
1.2.3 EIM Services Performance Requirements

None identified for Thor.

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1.2.4 EIM Services Interfaces Data Flow Diagrams

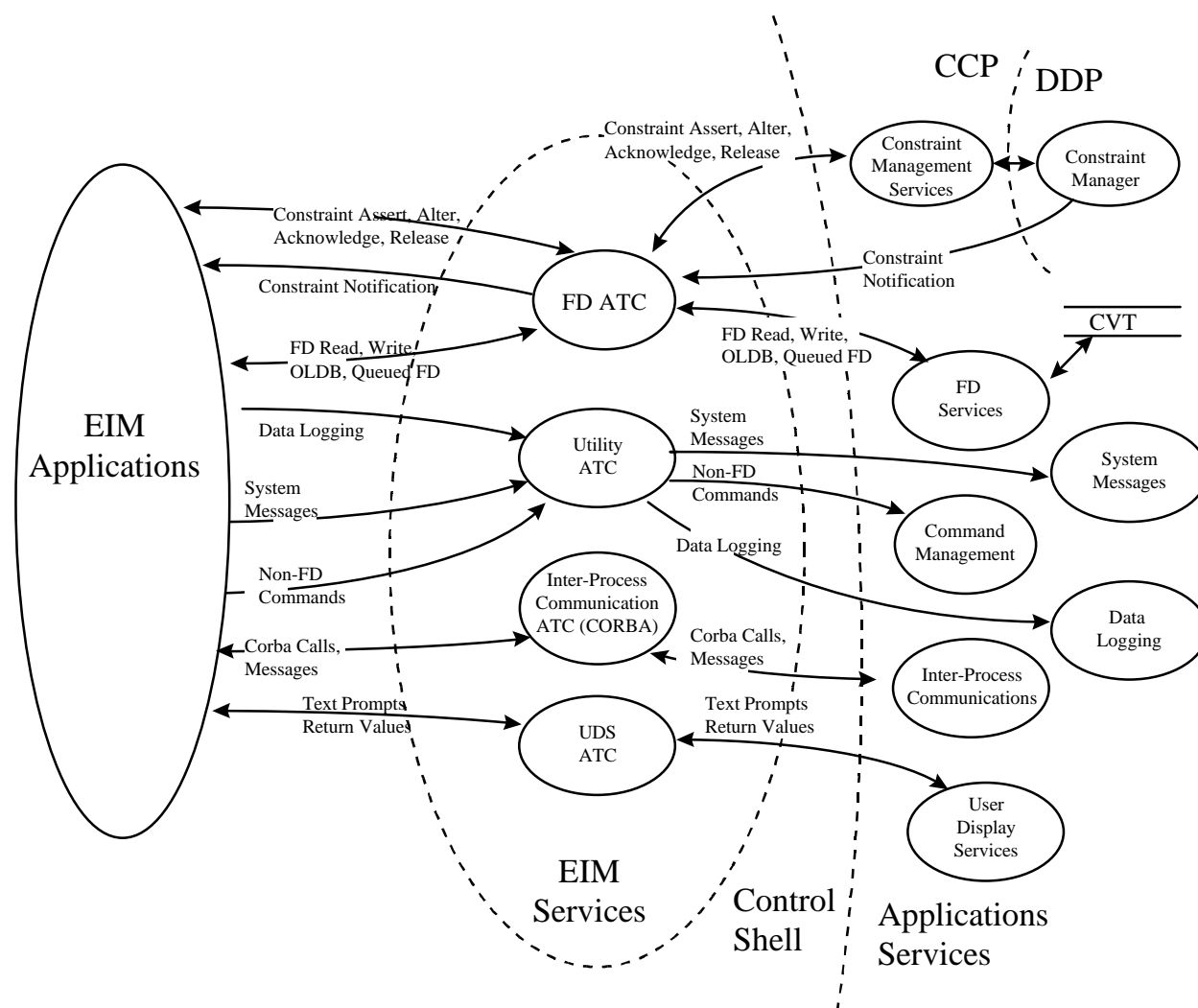
This diagram provides a pictorial representation of the data flow between EIM Services, EIM Applications and Application Services.



1.3 EIM Services Design Specification

1.3.1 EIM Services Detailed Data Flow

This diagram provides a pictorial representation of the data flow between EIM Services, EIM Applications and Application Services objects.



• Interface to the Constraint Management CSC

- EIM Services shall provide a capability for an EIM to Assert, Alter, Acknowledge, and Release Constraint Checking for an FD.
- Supports Multiple Constraints per FD, but each calling component must maintain the Constraint ID(s) related to its constraint(s)
- Constraint Interface will be contained in FD ATCs
- EIM Services shall provide a capability to receive Real-time Constraint Notifications via CORBA interface from Constraint Management.
- Notifications shall be distributed with a Control Shell Import Bubble on the Constraint Interface

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- **Interface to FD Services**
 - ATCs shall provide access to selected FD Object methods and data. The interface will be implemented with Control Shell components in a centralized repository directory.
 - EIM Services shall provide separate atomic components (ATCs) for each type of FD
 - Custom Interfaces for each type of FD
 - Access to all FD object methods and data
 - EIM Services shall provide Custom Types for communicating each type of FD:
 - Custom Types will provide type safe interfaces within EIM
 - Custom Types provide Merge and Split components to access each member type
 - EIM Services shall provide Control Shell Custom Interfaces for each type of FD
 - EIM Services standardizes ATC formats for ease in maintenance
- **Interface to System Messages**
 - EIM Services shall provide ATCs for EIM construction, allowing EIMs to send system messages, implemented via CORBA.
- ***Interface to Command Management***
- **Interface to Data Logging**
 - EIM Services shall provide ATCs for EIM construction, allowing EIMs to log messages.
- **Interface to Inter-Process Communications**
 - EIM Services shall provide ATCs for EIM construction, allowing EIMs to interact with other processes, implemented via CORBA.
- **Interface to User Display Dialog**
 - EIM services shall provide ATC wrappers to the Application service's User Display Dialog API's:
 - Input Dialog
 - Two Step Dialog
 - Message Dialog

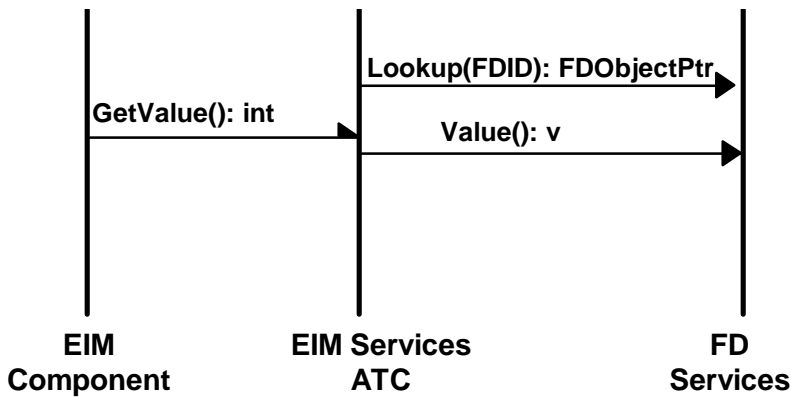
1.3.2 EIM Services External Interfaces

Operational Scenarios:

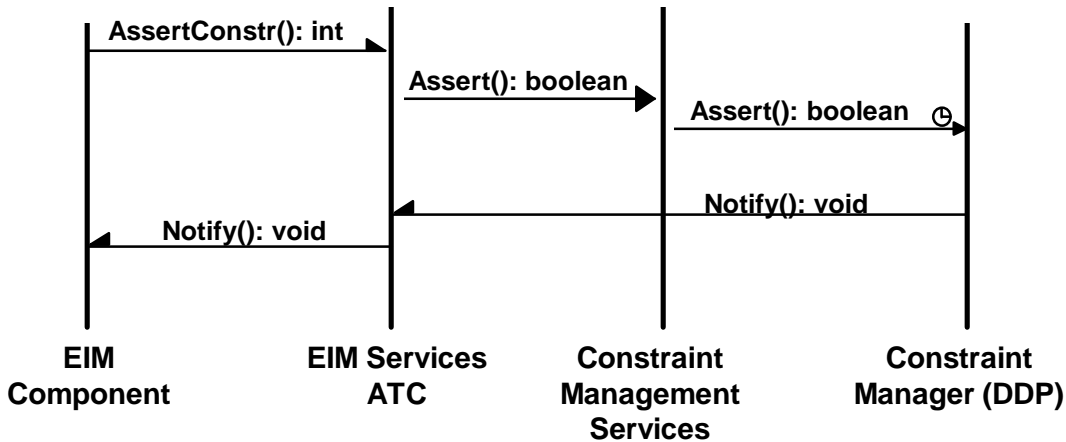
During a typical development of an End Item Manager application utilizing FD services, an atomic component graphical icon is selected from the repository and placed in the Control Shell graphical environment where a call to an FD Service is needed. The specific ATC for the needed FD service and FD type involved must be correctly selected, i.e. command capability of an analog AMP type. The FD name string must be wired to the ATC's FDname reference stub. Also all needed ATC's export method stubs must be wired to the calling component.

During execution, the calling component will activate any of the ATC's methods which will perform the associated FD services API call and return the results.

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The EIM Application shall perform all the required Constraint functions through the Constraint Management Services Interface on each FD ATC. Putting the Constraint functions on each FD will allow the constraint functions to be statically tied to their respective FD. Constraints shall be applied, queried, altered, and released through the methods encapsulated as bubbles within the Constraint Interface. Constraint Management Event Notifications will be received in the FD ATCs through a CORBA interface. The ATC shall then call the Notification method on all components connected to its interface. The EIM Application must provide the method to handle the notification function call (Export Bubble in calling component). The EIM Application shall receive the Notification including all CMS provided fields and it is up to the EIM Application to keep track of the Constraint Ids of each of the Constraints it sets.



[illegible]

```
#include "asv_fdsFunctionSesignator.h"
#include "asv_fdsFDDictionary.h"
#include "cs.h"                                // Controll Shell header

extern FDDictionary d;

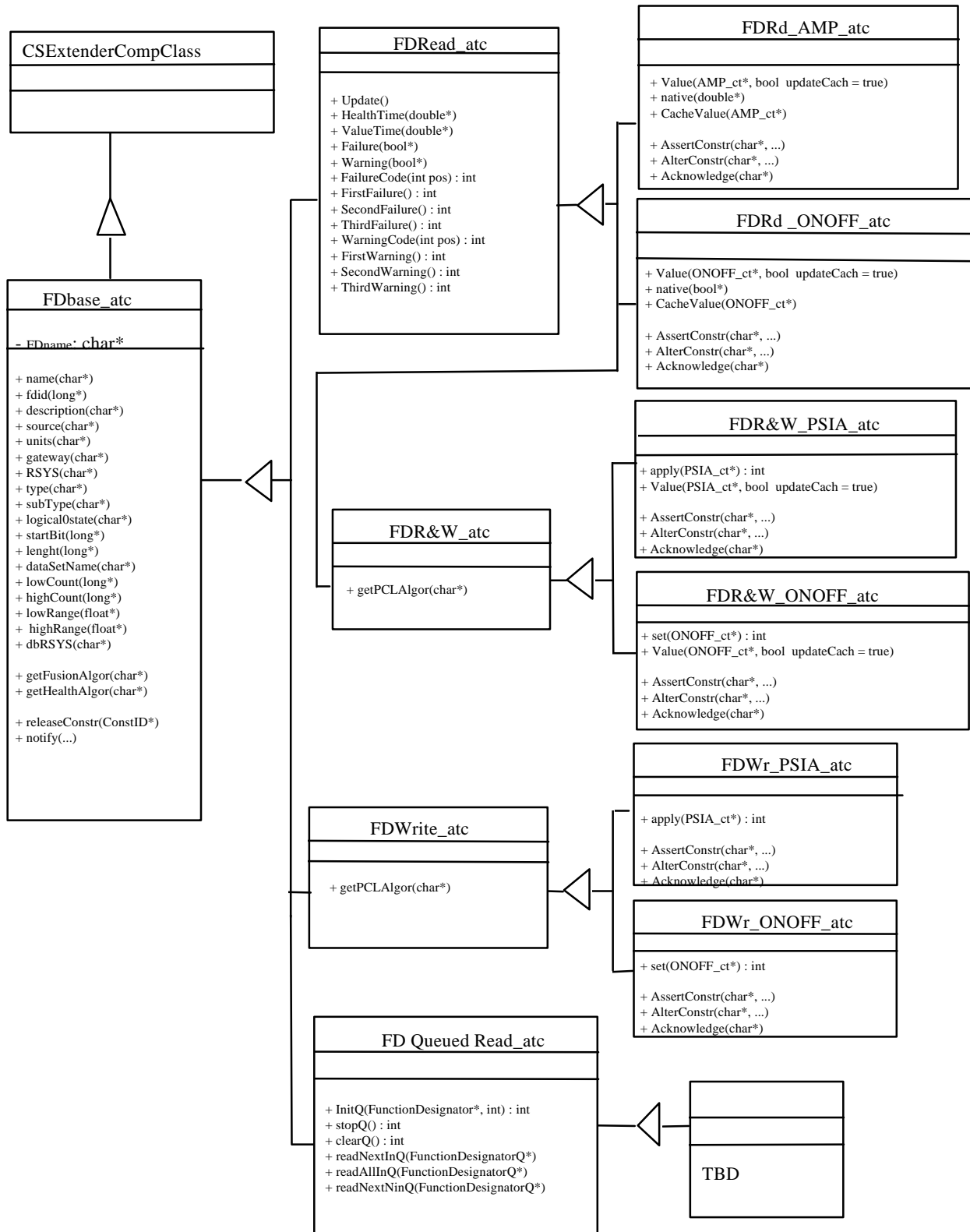
void FDRd_AMP_atc::onInstance()
{
    FDBObjectPtr = d.lookup( Fdname ); //get ptr to FD object by FD lookup by name
}

void FDRd_AMP_atc::Value(AMP *amp_ptr)
{
    amp_ptr->_val = FDBObjectPtr ->Value(); // FD Services API call
    return ;
}
```

EIM Services Software Requirements and Design Specification

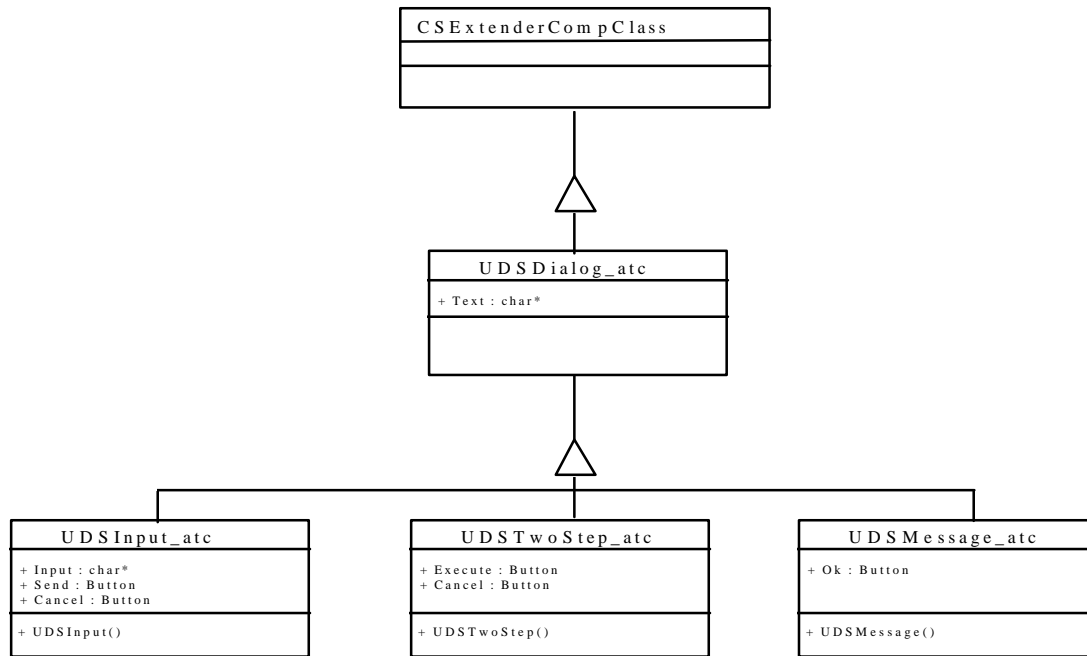
1.3.2.1 EIM Services Class Hierarchy

Control Shell FD/Constraint Services Wrappers (ATC's) - Class Hierarchy Diagram



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Control Shell User Display Dialog Services Wrappers (ATC's) - Class Hierarchy Diagram



1.3.2.2 EIM Services Display Formats

N/A

1.3.2.3 EIM Services Input Formats

N/A

1.3.2.4 Recorded Data

N/A

1.3.2.5 EIM Services Printer Format

N/A

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1.3.2.6 Interprocess Communications (C-to-C Communications?)

All inter-process communication is via CORBA.

1.3.2.7 EIM Services External Interface Calls (e.g., API Calling Formats)

This is the list of methods available to a calling EIM component.

FD Read Only ATC interfaces for FD AMP type:

- + Value(AMP_ct*, bool updateCach = true) - method to call FD services and return FD value
- + native(double*) - method to call FD services and return FD value in native C++ type
- + CacheValue(AMP_ct*) - method to call FD services and return FD value from cache

- + Update() - method to call FD services and perform atomic read of FD data from CVT.
- + HealthTime(double*) - method to call FD services and return health update time.
- + ValueTime(double*) - method to call FD services and return value update time.
- + Failure(bool*) - method to call FD services and return failure health bit.
- + Warning(bool*) - method to call FD services and return warning health bit.
- + FailureCode(int pos) : int - method to call FD services and return failure code.
- + FirstFailure() : int - method to call FD services and return first failure code.
- + SecondFailure() : int - method to call FD services and return second failure code.
- + ThirdFailure() : int - method to call FD services and return third failure code.
- + WarningCode(int pos) : int - method to call FD services and return warning code.
- + FirstWarning() : int - method to call FD services and return first warning code.
- + SecondWarning() : int - method to call FD services and return second warning code.
- + ThirdWarning() : int - method to call FD services and return third warning code.

- + name(char*) - method to call FD services and return FD name.
- + fdid(long*) - method to call FD services and return real time control net ID.
- + description(char*) - method to call FD services and return FD description.
- + source(char*) - method to call FD services and return source of FD data.
- + units(char*) - method to call FD services and return engineering units of FD.
- + gateway(char*) - method to call FD services and return gateway processor ID.
- + RSYS(char*) - method to call FD services and return TCID responsible system.
- + type(char*) - method to call FD services and return FD data type.
- + subType(char*) - method to call FD services and return FD data subtype.
- + logical0state(char*) - method to call FD services and return logical zero state.
- + startBit(long*) - method to call FD services and return starting bit position of FD data.
- + lenght(long*) - method to call FD services and return FD data length.
- + dataSetName(char*) - method to call FD services and return time homogenous data set name.
- + lowCount(long*) - method to call FD services and return low count limit.
- + highCount(long*) - method to call FD services and return high count limit.
- + lowRange(float*) - method to call FD services and return low engineering value limit.
- + highRange(float*) - method to call FD services and return high engineering value limit.
- + dbRSYS(char*) - method to call FD services and return Databank responsible system.

- + releaseConstr(const ConstraintID IN, ConstraintID OUT, CompCode OUT) - method to call constraint management to release a constraint.
- + notify(ConstraintID, Time, State, Value) - method to notifies a component of a constraint exception.
- + AssertConstr(ConstrExpression, Attribute, UpperLimit, LowerLimit, DeltaChange, Period, Sample, ConstraintID OUT, CompletionCode OUT) - method to call constraint management to assert a constraint.
- + AlterConstr(ConstraintID IN/OUT, ConstrExpression, Attribute, UpperLimit, LowerLimit, DeltaChange, Period, Sample, CompletionCode OUT) - method to call constraint management to alter a constraint.

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+ Acknowledge(const ConstraintID IN, ConstraintExpression) - method to call constraint management to acknowledge a constraint.

+ getFusionAlgor(char*) - method to call FD services and return a FD fusion algorithm.

+ getHealthAlgor(char*) - method to call FD services and return a FD health algorithm.

FD Write Only ATC interface for FD type PSIA:

+ apply(PSIA_ct*) : int - method to call FD services and command an FD

+ getPCLAlgor(char*) - method to call FD services and return a FD PCL algorithm.

+ name(char*)

+ fdid(long*)

+ description(char*)

+ source(char*)

+ units(char*)

+ gateway(char*)

+ RSYS(char*)

+ type(char*)

+ subType(char*)

+ logical0state(char*)

+ startBit(long*)

+ lenght(long*)

+ dataSetName(char*)

+ lowCount(long*)

+ highCount(long*)

+ lowRange(float*)

+ highRange(float*)

+ dbRSYS(char*)

+ getFusionAlgor(char*)

+ getHealthAlgor(char*)

+ releaseConstr(const ConstraintID IN, ConstraintID OUT, CompCode OUT)

+ notify(ConstraintID, Time, State, Value)

+ AssertConstr(ConstrExpression, Attribute, UpperLimit, LowerLimit, DeltaChange, Period, Sample, ConstraintID OUT, CompletionCode OUT)

+ AlterConstr(ConstraintID IN/OUT, ConstrExpression, Attribute, UpperLimit, LowerLimit, DeltaChange, Period, Sample, CompletionCode OUT)

+ Acknowledge(const ConstraintID IN, ConstraintExpression)

User Display Input Dialog ATC:

+ UDSInput() - method to call UDS and create an Input dialog box.

User Display Two Step Dialog ATC:

+ UDSTwoStep() - method to call UDS and create a two step dialog box.

User Display Message Dialog ATC:

+ UDSMessage() - method to call UDS and create a message dialog box.

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1.3.2.8 EIM Services Table Formats

N/A

1.3.3 EIM Services Test Plan

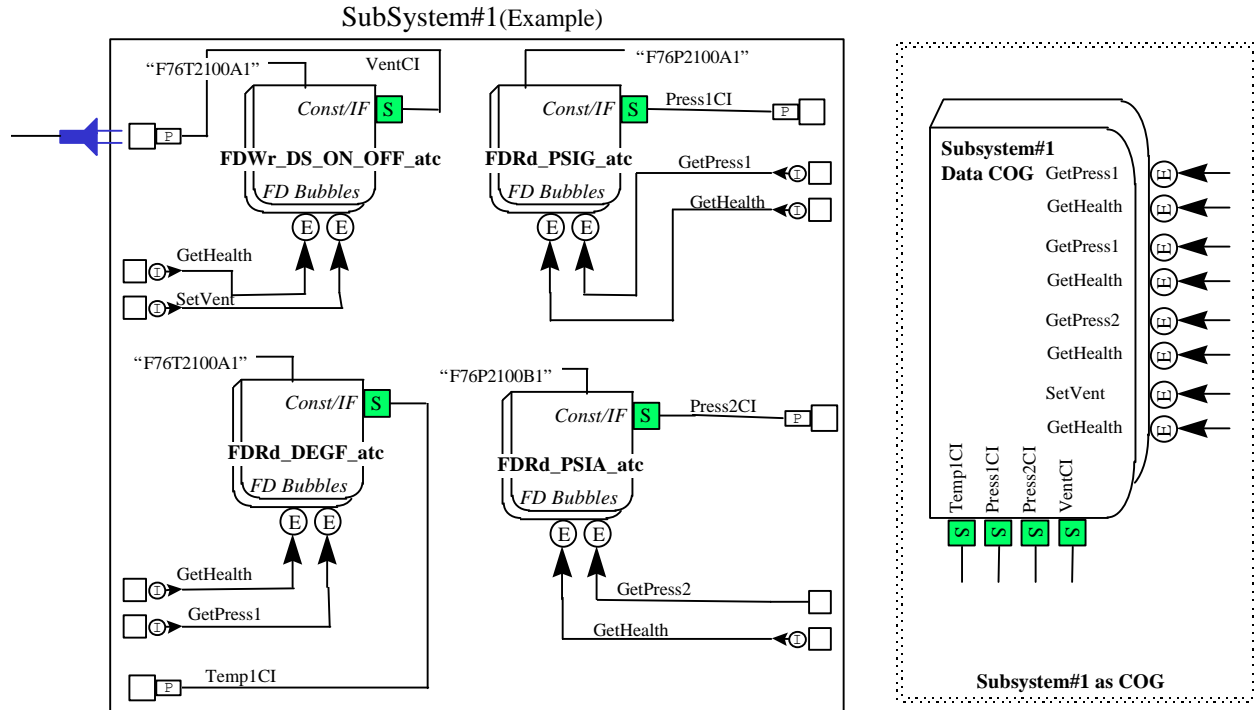
EIM Service's ATCs to FD Services system-level tests may be run in either or both the IDE or SDE environments. These tests are run on the basic CCWS, CCP and DDP platforms. There are no specific hardware configurations required. The minimal applications software configuration includes Data Distribution, Application Services and any programs and files necessary to run the CCP. EIM Service's ATCs to FD Services testing also requires a CLCS application or a EIM application test tool that exercises the FD read, FD write, OLDB read, and Queued Multi-Sample FD services. A test EIM Applications will be required for the testing. At a minimum the test application shall have components of each type of FD and a test Control Shell FSM.

The specific test cases that will be run include:

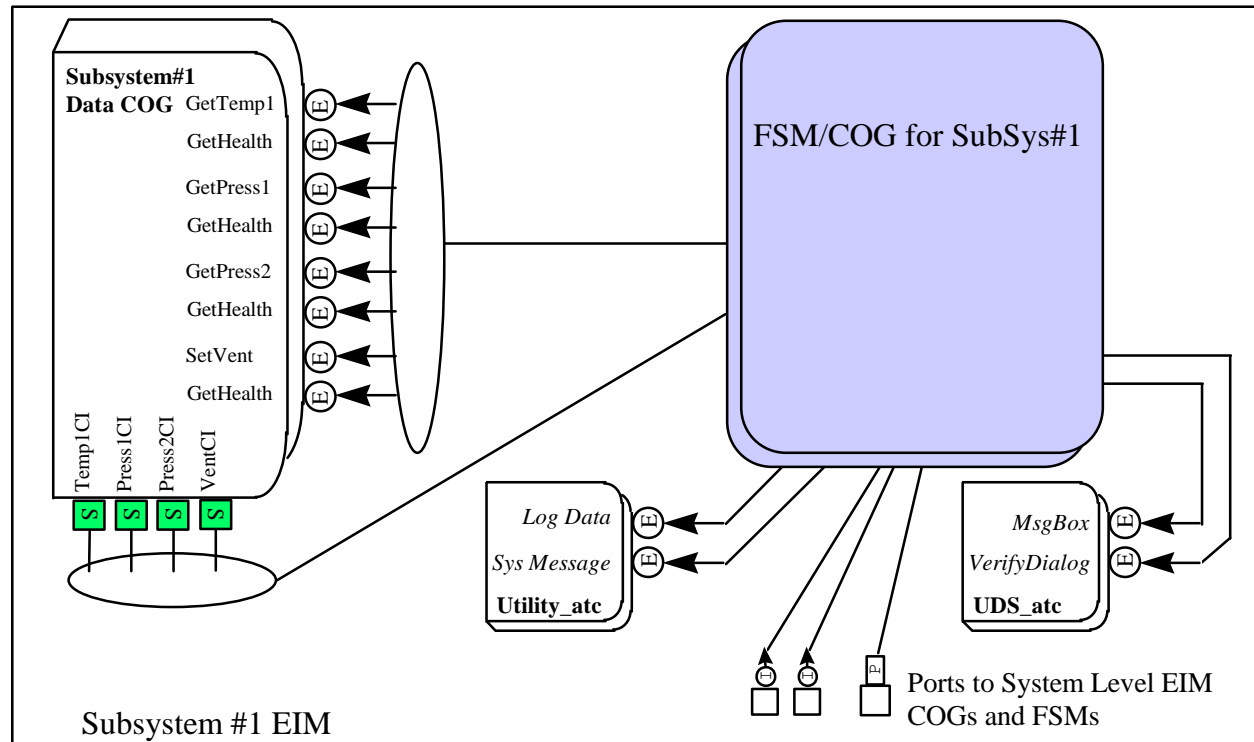
1. read FD value and verify type safe data manipulations
2. command FD and verify that FD CMD is called.
3. read queued multi-sample FD data.
4. read OLDB provided data.
5. Assert a constraint on an FD, using the Constraint Viewer to verify
6. Repeat Test #1 and then Alter the Constraint
7. Assert two constraints on a single FD
8. Assert a constraint, force the value out of constraint, and then verify the receipt of the Constraint Notification
9. Release a Constraint
10. Using an FSM Assert several constraints and have the FSM respond to Constraint Notifications by changing states or performing some operation.
11. Turn data logging on & off and verify log.
12. Issue/Send system messages and verify receipt.
13. Generate non-FD command and verify receipt.
14. Inter-EIM commanding, verify second EIM receives (CORBA) command.
15. Inter-process communication, verify second process receives (CORBA) message.
16. Generate dialog windows and verify button actions.
17. All tests will include in-range and out of range values.

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DESIGN SCHEME- EIM USING CONSTRAINTS AND FDs



DESIGN SCHEME - EIM COG AND FSM FOR SUBSYSTEM CONTROL



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Appendix A - APIs

API Index	SLS Rqmt#	User Apps Doc Rqmt #	Requirement	Delivery Needed (post-CIT)	ASV DP2 Rqmt #	CSCI / CSC	What is really needed?
11.1		4.2.1.1.1	The API shall provide a method to issue values to analog output FD's to support on-board port/MDM specifications.	Atlas		"FD Svcs, CMD"	
15.0		4.2.1.5	The capability shall be provided to support on-board/MDM specifications in discrete commands.	Atlas		"OBS, CMD"	LDB Commands. B. Hooker sees App Svcs as providing the user layer
39.0	2.2.5.4.	4.2.4.1.11	The API shall provide a method for determining which system asserted a constraint when an FD is marked with a constraint limit violation.	Atlas		CMS	"User Class will be known. But, higher level of specificity is required, workstation ID might be required. Richkerd thinks this n not be a real requirement."
47.1	2.2.5.3.	4.2.4.2.2	The API shall provide a method for reading all fusion logic associated with an FD.	Atlas		"DF / UDS, DFViewer"	
47.2	2.2.5.3.	4.2.4.2.3	The API shall provide a method for retrieving a list of all FD's associated with a data fusion FD.	Atlas		UDS / DF	
49.0		4.2.4.1.x	The API shall provide a method for changing the constraint condition for an enumerated FD.	Atlas	3.2.2.2.3	CMS	"A Constraint Management API, command defined at the packet level, and a user API"
49.1		4.2.4.3.2	The API shall provide a method for changing the significant change value of an analog FD.	Atlas		UDS(DH) + CMD	Signif. Change value specifies t of bits that have to change for an analog measurement before the change is reported to the system.
49.2		4.2.4.3.3	The API shall provide a method for changing the stale data count for any FD.	Atlas		FD Svcs	May be deleted (replaced by DH).
49.3		4.2.4.3.4	The API shall provide a method for changing calibration coefficients.	Atlas		FD Svcs + CMD	
51.0		4.2.4.3.7	The API shall provide a method to activate or inhibit stale data checking on a per FD basis.	Atlas		FD Svcs	May be deleted (replaced by DH).
53.1		4.2.4.3.9	The API shall provide a method for reading the current significant change value for an analog FD.	Atlas			May be deleted.
53.2	2.2.5.2.	4.2.4.3.10	The API shall provide a method to read the current stale data count for any FD.	Atlas		FD Svcs / DH	May be deleted (replaced by DH).
70.1		4.3.1.4	The API shall provide a method to activate or inhibit stale data checking on any gateway.	Atlas		FD Svcs + CMD	May be deleted (replaced by DH).
70.2		4.3.1.5	The API shall provide a method to activate or inhibit data fusion limit checking for any class of limits.	Atlas		CMS + DF	

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Appendix A - APIs

API Index	SLS Rqmt#	User Apps Doc Rqmt #	Requirement	Delivery Needed (post-CIT)	ASV DP2 Rqmt #	CSCI / CSC	What is really needed?
74.1		4.3.2.4	The API shall provide a method to read the stale data check processing status of any gateway.	Atlas			May be deleted (replaced by DH).
171.0	2.1.1.1.3	4.10.19	Functionality shall be provided to control the SRBMDM's (lock/unlock). (Reference KSC-LPS-OP-033-4 Section 6.0)	Atlas (Delta)		"OBS, CMD"	
23.0		4.2.2.2	The API shall provide a method for reading the current value of an analog FD in raw counts.	Atlas (Redstone)		FD Svcs CMD	Instead of returning the literal value(open / closed) would return the actual word containing the discrete bit. Special API comm
26.0		4.2.2.5	The API shall provide a method for reading the current value of a discrete FD in unprocessed format.	Atlas (Redstone)		FD Svcs	Raw G/W word. Rich wants the whole word as we received it from the CVT.
101.2		4.7.2.2	The API shall provide a method to set the systems CDT/MET.	Atlas (Redstone)		"CCS, TS, CMD"	
101.3		4.7.2.3	"The API shall provide a method to determine if the CDT, or MET is using internal simulation of an external data source."	Atlas (Redstone)		"TS, CMD"	
102.1		4.7.2.5	The API shall provide a method for reading the system CDT/MET.	Atlas (Redstone)		FDS	
102.2		4.7.2.6	The API shall provide a method to start/hold the system CDT/MET.	Atlas (Redstone)		"CCS, TS, CMD"	
102.3		4.7.2.7	The API shall provide a method to start/hold the system CDT/MET at a specified time.	Atlas (Redstone)		"CCS, TS, CMD"	
119.0	2.1.1.1.2.1	4.10.2	Functionality shall be provided to request an MDM or FLEX MDM to perform an internal function. The following functions shall be supported: (Reference KSC-LPS-OP-033-4 Section 3.2.3)	Atlas (Titan)		"OBS, CMD"	
120.0		4.10.2.1	· Master Reset	Atlas (Titan)			
121.0		4.10.2.2	· Perform BITE Tests 1, 2, 3 and 4"	Atlas (Titan)		"ASV/OBS, CMD"	
122.0		4.10.2.3	· Load the BITE Status Register	Atlas (Titan)		"ASV/OBS, CMD"	
123.0		4.10.2.4	· Perform a Wrap Test	Atlas (Titan)			

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Appendix A - APIs

API Index	SLS Rqmt#	User Apps Doc Rqmt #	Requirement	Delivery Needed (post-CIT)	ASV DP2 Rqmt #	CSCI / CSC	What is really needed?
124.0	2.1.1.1.2.2	4.10.3	Functionality shall be provided to communicate with the Master Event Controller BTUs and to command their test and control functions. The following functions shall be supported: : (Reference KSC-LPS-OP-033-4 Section 3.2.4)	Atlas (Titan)		"OBS, CMD"	
126.0		4.10.3.2	· Master Reset	Atlas (Titan)			
127.0		4.10.3.3	· Wrap Test	Atlas (Titan)			
135.0	2.1.1.1.2	4.10.6	"Functionality shall be provided to perform ""read"" operations on the following on-board components. The reads return response data words from the specified component. (Reference KSC-LPS-OP-033-4 Sections 3.3.2 through 3.3.6) "	Atlas (Titan)		"OBS, CMD"	
137.0	2.1.1.1.2.1	4.10.6.2	· MultiplexerDemultiplexer	Atlas (Titan)			
138.0	2.1.1.1.2.2	4.10.6.3	· Master Events Controller	Atlas (Titan)			
139.0	2.1.1.1.2.3	4.10.6.4	· Pulse Code Modulation Master Unit	Atlas (Titan)			
141.0		4.10.7	Functionality shall be provided to control the LDB IO functions performed by the GPC. This capability shall cause the desired request to be sent to the GPC which is currently communicating with the LDB gateway so that the current mode and/or control p	Atlas (Titan)		"OBS, CMD"	
70.3	2.2.9.3.	4.3.1.6	The API shall provide a method to activate or inhibit active/standby switch over for any redundant subsystem.	Atlas*		System Integrity	
75.1	2.2.9.3.	4.3.2.6	The API shall provide a method for reading the summary error indicators and counts from any subsystem.	Atlas*		Sys Int	
101.1		4.7.2.1	The API shall provide a method to set the system GMT.	Atlas* (Redstone)		"(CCS), TS, CMD"	
76.1		4.4.1.2	The API shall provide a method for assigning a DDVT display to an open window.	deleted			
77.1		4.4.1.4	The API shall provide a method for changing the color of a display object on a displayskeleton.	deleted			

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Appendix A - APIs

API Index	SLS Rqmt#	User Apps Doc Rqmt #	Requirement	Delivery Needed (post-CIT)	ASV DP2 Rqmt #	CSCI / CSC	What is really needed?
105.1		4.8.2.1	The API shall provide a method for recording messages to predefined sections of a user application display.	deleted		SMS (no ASV)	
17.0		4.2.1.7	The API shall support one-to-one and one-to-many options for the issuance of values to FD's	Redstone		"FDS(DH), CMD"	"For EIM safing, also for User Displays; send CMD w/ linked list for multiple FDs."
25.0	??	4.2.2.4	The API shall provide a method for reading the current value of a discrete FD in engineering units.	Redstone		FD Svcs	"Open, Closed, etc.."
27.0		4.2.2.6	The API shall provide a method to read the time of the last change in value of the FD.	Redstone		FD Svcs	
16.0		4.2.1.6	The API shall provide a method for issuing a value to digital pattern output FD's.	Redstone and CMD in Thor		"FD Svcs, CMD"	
18.0		4.2.1.8	The API shall validate that issued values are compatible with Function Designator types prior to issuing the command.	Redstone Thor(2)		"FD Svcs, CMD"	Type safety
2.0		4.1.1.2	The API shall be able to pass engineering unit data types across interface boundaries in a type safe way.	Redstone*		FD Svcs	Compile and link time checking wanted
3.0		4.1.2	The API shall provide an efficient type safe mechanism for manipulating computations involving engineering units.	Redstone*		FD Svcs	Compile and link time checking wanted
12.0		4.2.1.2	The API shall provide a method for setting a discrete output FD's.	Redstone*		"FD Svcs, CMD"	
22.0		4.2.2.1	The API shall provide a method for reading the current value of an analog FD in engineering units.	Redstone*		FD Svcs	
28.0		4.2.2.7	The API shall provide a method to read the health status the last change of an FD.	Redstone*		FD Svcs	
31.0		4.2.3.1	"The API shall provide a method to identify function designators that shall be delivered via queued service, providing access to every change value in time ordered fashion"	Redstone*		FD Svcs / DD	
32.0		4.2.3.2	The API shall provide a method to read the next value of a multi-sample queued function designators.	Redstone*	2.2.2.2.4	FD Svcs	

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33.0		4.2.3.3	The API shall provide a method to read the next N values of a multi-sample queued function designator.	Redstone*	2.2.2.2.5	FD Svcs	
34.0		4.2.3.4	The API shall provide a method to clear all queued samples pending for the application.	Redstone*	2.2.2.2.6	FD Svcs	
35.0	2.2.5.4.	4.2.3.5	The API shall provide a method to cancel queued function designator delivery by FD.	Redstone*	2.2.2.2.9	FD Svcs	
66.0		4.2.5.1	The API shall provide a method for querying the on-line data bank by FDID or FD name.	Redstone*	FD Svcs		Read OLDB
67.0		4.2.5.2	The API shall provide a method for querying any piece of information stored in the on-line data bank for a particular FD.	Redstone*	2.2.2.1.9	FD Svcs	
76.0		4.4.1.1	The API shall provide a method for opening a display window at the workstation	Redstone*		Sys. Viewers	
77.0		4.4.1.3	The API shall provide the ability to close a window at the workstation.	Redstone*		SL platform	User executed command
78.0		4.4.1.5	"The API shall provide a method to issue a prompt to, and receive response from, a user display window."	Redstone*		"SL, platform"	User executed command
82.0		4.5.1.2	The API shall provide a method to terminate an application and release all system resources associated with the application.	Redstone*		ITS? CMP?	
91.0		4.5.2.5	The API shall provide a method to specify and cancel event notification and an event handler for user selection of display objects.	Redstone*		"UDS, SL"	Delete
97.0		4.6.1	The API shall provide a method to identify system errors caused by API calls.	Redstone*		AI?	Exception/error codes
101.0		4.7.1.2	The API shall provide a method to specify multiple timers within a single application.	Redstone*		"TS, CMD"	
103.0		4.8.1.1	The API shall provide a method to record a system message for distribution and display.	Redstone*		SMS	

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104.0		4.8.1.2	The API shall provide a method for retrieving system message text from the system message data base based on a predefined system message number.	Redstone*		SMS	
105.0		4.8.1.3	"The API shall provide a method for specifying a system message group, message number, severity indicator, and message inserts."	Redstone*		SMS	
1.0		4.1.1.1	"The API shall preserve the current LPS engineering unit model. The API shall be able to work with temperatures, pressures, discrete states, and enumerated states."	Redstone* énum- Thor others- Redstn)		ASV-all	Compile and link time checking wanted
29.0		4.2.2.8 (new)	The API shall provide text field associated with a health reason code.	Thor		"SMS, ASV?"	
30.0		4.2.2.9 (new)	The API shall provide the text field associated with a system message.	Thor		SMS	
79.1		4.4.1.7	The API shall provide a method for writing a numeric value to a display object at the workstation.	Thor		"UDS, SL, platform"	String formatting
81.0		4.5.1.1	The API shall provide a method to initialize an application and register its existence with the system.	Thor		"ITS/CMP OPS CM, SSI"	
83.1		4.5.1.3.1	Test Application Scripts	Thor		TAS	Rich lkerd had this removed from deleted status
98.0		4.6.2	The API shall provide a method to translate API error codes into system text messages which may be displayed for the user.	Thor		"All APIs, SMS"	
100.0		4.7.1.1	The API shall provide a method to specify timer events which can occur at user defined intervals with a granularity of 10 milliseconds.	Thor		"TS, CMD"	
107.0		4.8.2.3	The API shall provide text field associated with a system message.	Thor (NewRqmt)		SMS	
95.0		4.5.2.9	The API shall provide a method to activate or inhibit display object notification active for the application.	Thor (Redstone)		"UDS, SL"	Delete?
42.0	2.2.5.4.		The API shall provide a method for reading the return to limits indicator (event) of an digital pattern / Enumerated FD.	Thor(1)		"CMS, Constr Mgmt"	Event notification

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46.0	2.2.5.4.	4.2.4.1.10	The API shall provide a method for reading an FD's high limit constraint indicator (event) for all analog constraint limit sets.	Thor(1)		CMS	Event details
11.0		4.2.1.1	The API shall provide a method to apply values to analog output FD's.	Thor(1) (Atlas)		"FD Svcs, CMD"	
13.0		4.2.1.3	"The API shall set discrete output FD's using the literal key words OPEN, CLOSE, TRUE, FALSE, WET, DRY, ON, OFF."	Thor(1) (Atlas)		FD Svcs	
14.0		4.2.1.4	The API shall provide a method to specify a time value for a discrete command. This command shall set the command to the indicated state for the specified period and then return it to the original state.	Thor(1) (Atlas)		"FD Svcs, CMD"	"Set FD1 on for 12 seconds. Ric expects that the application write able to do this as a ""command"" from an application. "
19.0		4.2.1.9	The API shall provide a method for issuing values to a pseudo function designator.	Thor(1) (Atlas)		"FD Svcs, CMD"	Command must support pseudo FD? FD Svcs. already supports
36.0	2.2.5.4.	4.2.4.1.1	The API shall provide a method for changing the constraint limits associated with an analog FD.	Thor(1) (Atlas)	3.2.2.2.1	"ConMgmt, CMD, CMS"	"A Constraint Management API, command defined at the packet level, and a user API"
37.0	2.2.5.4.	4.2.4.1.2	The API shall provide a method for changing the constraint state of a discrete FD.	Thor(1) (Atlas)	3.2.2.2.2	"ConMgmt, CMD, CMS"	"A Constraint Management API, command defined at the packet level, and a user API"
38.0	2.2.5.4.	4.2.4.1.3	The API shall provide a method for changing the constraint condition for a digital pattern FD.	Thor(1) (Atlas)	3.2.2.2.3	"ConMgmt, CMD, CMS"	"A Constraint Management API, command defined at the packet level, and a user API"
40.0	2.2.5.4.	4.2.4.1.4	The API shall provide a method to activate or inhibit constraint checking associated with an FD for an application.	Thor(1) (Atlas)		CMS	Rich lkerd does not see a need this capability as being different from Assert and release
43.0	2.2.5.4.	4.2.4.1.7	The API shall provide a method for reading the FD constraint indicator (event) for an FD.	Thor(1) (Atlas)		CMS	Event details
44.0	2.2.5.4.	4.2.4.1.8	The API shall provide a method for reading the return to limits indicator (event) of an FD.	Thor(1) (Atlas)		CMS	Event details
45.0	2.2.5.4.	4.2.4.1.9	The API shall provide a method for reading an FD's low limit indicator (event) for all analog constraint limit sets.	Thor(1) (Atlas)		CMS	Event details
72.0	2.2.9.3.	4.3.2.1	The API shall provide a method to read the current health status of any subsystem within the CLCS.	Thor(1) (Atlas)		SubSys Integrity (SSI)	Includes G/W and HIM status.

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85.0		4.5.1.4	The API shall provide methods for communicating between concurrently executing applications as described in 4.5.1.3 above.	Thor(1) (Atlas)		CORBA	
24.0		4.2.2.3	The API shall provide a method for reading the current value of a digital pattern FD and enumerated type FD.	Thor(1) (Redstone)		FD Svcs	"Hex, Octal, BCD, Enum types?"
55.0	2.2.5.2.	4.2.4.4.1	"The API shall provide a method for determining if a function designator's health status is OK, FAILED, or WARNING."	Thor(1) (Redstone)		FD Svcs / DH	string and bits themselves
56.0	2.2.5.2.	4.2.4.4.2	The API shall provide a method of reading the detailed health status from the health status word for a function designator. The detailed health shall identify the following conditions:	Thor(1) (Redstone)		FD Svcs / DH ?	Reason codes
57.0	2.2.5.2.	4.2.4.4.2.1	Was the last value change or refresh data?	Thor(1) (Redstone)			
58.0	2.2.5.2.	4.2.4.4.2.2	Is processing active or inhibited for this FD?	Thor(1) (Redstone)		FD Svcs / CMD	"Need to know if this is equivalent to FEP proc"
59.0	2.2.5.2.	4.2.4.4.2.3	Is gateway group processing active or inhibited for this FD?	Thor(1) (Redstone)		?	
60.0	2.2.5.2.	4.2.4.4.2.4	Is Engineering active or inhibited for this FD?	Thor(1) (Redstone)		?	Maybe deleted
61.0	2.2.5.2.	4.2.4.4.2.5	Is the data path associated with this FD active or inhibited?	Thor(1) (Redstone)		DH?	
62.0	2.2.5.2.	4.2.4.4.2.6	Is application advisory notification active or inhibited for this FD?	Thor(1) (Redstone)		EIM/SMS?	
63.0	2.2.5.2.	4.2.4.4.2.7	Is engineering bypass active or inhibited for this FD?	Thor(1) (Redstone)		?	
65.0	2.2.5.2.	4.2.4.4.4	The API shall provide a method to change an FD's status indicator (event) in order to mark the measurement bad or good.	Thor(1) (Redstone)		"FD Svcs, DH"	Write Data health
87.0		4.5.2.1	The API shall provide a method to specify and cancel event notification and an event handler for the expiration of a system timer with a granularity of 10 milliseconds.	Thor(1) (Redstone)		"(CCS), TS"	
90.0		4.5.2.4	The API shall provide a method to specify and cancel event notification and an event handler for the occurrence of an FD constraint violation.	Thor(1) (Redstone)		"CMS, Constr Mgmt"	Release a constraint

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94.0		4.5.2.8	The API shall provide a method to activate or inhibit all FD constraint notifications active for the application.	Thor(1) (Redstone)		"CMS, Constr Mgmt"	
102.0		4.7.2.4	The API shall provide a method for reading the systems GMT.	Thor(1) (Redstone)		FDS	
84.0		4.5.1.3.2	End Item Managers	Thor(1) (Titan)		EIM Svcs	
8.0		4.1.5.2	Command blocked by authentication	Thor(2)		CMD	
9.0		4.1.5.3	Command parameter mismatch	Thor(2)		CMD	
10.0		4.1.5.4	Time out	Thor(2)		CMD	
5.0		4.1.4	The API call shall return an indicator to the calling process which indicates success or failure of an API call and the reason associated with any failure condition.	Thor(2) (Atlas)		"All APIs, CMD"	"Exceptions for C++, and error codes for C programs"
6.0	2.2.3.3.?	4.1.5.	The API shall provide a method of indicating why a command has failed. This status shall indicate the following error conditions:	Thor(2) (Atlas)		"CMD, SMS"	
41.0	2.2.5.4.	4.2.4.1.5	The API shall provide a method for reading the constraint limits associated with an analog FD for an application.	Thor(2) (Atlas)	3.2.2.3.1	CMS	Query method
48.0		4.2.4.3.1	The API shall provide a method for changing the sample rate of any GSE FD.	Thor(2) (Atlas)		FD Svcs + CMD	
52.0		4.2.4.1.x	The API shall provide a method for reading the constraint conditions associated with a discrete FD for an application.	Thor(2) (Atlas)	3.2.2.3.2	CMS	Query method
53.0		4.2.4.3.8	The API shall provide a method of reading the current sample rate of an FD.	Thor(2) (Atlas)		FD Svcs / CMD	CMD to G/W to read current sample rate.
75.0	2.2.5.4.2	4.3.2.5	The API shall provide a method to read the constraint limit processing status in the data fusion function.	Thor(2) (Atlas)		Constr. Mgmt.	Not sure what difference this would make to the Application Services layer
111.0		4.9.3	The API shall provide a method for logging user defined data formats to a persistent archive.	Thor(2) (Atlas)		LDS/SDC /OPS CM?	
112.0		4.9.4	The API shall provide a method for logging persistent FD information.	Thor(2) (Atlas)		LDS/SDC /OPS CM?	
113.0		4.9.5	"The API shall provide a method for initializing, updating, and reading persistent storage structures."	Thor(2) (Atlas)		LDS/SDC /OPS CM?	

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114.0		4.9.6	"The API shall provide a method for opening, closing, updating, reading, and writing disk files in a user definable format."	Thor(2) (Atlas)		LDS/SDC /OPS CM?	
79.2		4.4.1.8	The API shall provide a method for writing text labels to the programmable front panel (PFP) or equivalent interface.	Thor(2) (Redstone)		"UDS, SL, platform"	PFP implementation support
86.0		4.5.1.5	The API shall provide a method for allowing a user application to enter and exit a higher priority state.	Thor(2) (Redstone)		OS	
93.0		4.5.2.7	The API shall provide a method to activate or inhibit all event notifications active for application.	Thor(2) (Redstone)			For EIMs; w/ linked list for multip FDs. 4.5.; 4.5.2.8 - 10 are bullets under 4.5.2.7
106.0		4.8.2.2	"The API shall provide a method for recording a time tagged message to any or all of the available output devices including the local printer, archival function, etc."	Thor(2) (Redstone)		SMS	
109.0		4.9.1	The API shall provide a method for logging function designators values and health indicators to a permanent archive.	Thor(2) (Redstone)		LDS/SDC /OPS CM?	4.9.x is for a RDBMS or equivalent for storing pseudo FD values for test configurations. Currently implemented in GOAL disk files.
110.0		4.9.2	The API shall provide a method for logging text data to a permanent archive.	Thor(2) (Redstone)		LDS/SDC /OPS CM?	
28.1		4.2.2.8	The API shall provide a method for converting a raw data word into measurement data. (Reference KSC-LPS-OP-033-04 Section 2.1)	Thor(3)		"OBS, EIMS?"	Is this date correct?
108.0	2.2.4.2.?	4.8.2.4	The API shall provide the text field associated with a system message.	Thor(3)		SMS	
4.0		4.1.3	The API shall support strong compile time checking and external symbol resolution. The API shall minimize the need for run-time dependency checking.	Thor(3) (Atlas)		"FD Svcs, Test Build, Ops CM"	FD Svcs work. Setting the priority is really the issue for Thor. Paul starting work on fusion algorithm
47.0	2.2.5.3.	4.2.4.2.1	"The API shall provide a method to activate, inhibit, or status any data fusion processing on a per FD basis."	Thor(3) (Atlas)		DF	
50.0		4.2.4.3.6	The API shall provide a method to activate or inhibit measurement processing on a per FD basis.	Thor(3) (Atlas)		FD Svcs + CMD	At G/W.

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54.0		4.2.4.3.11	The API shall provide the capability to read the current hardware address of an FD.	Thor(3) (Atlas)		G/W	Need to be able to give entire ro of command down to its ultimate destination
68.0		4.3.1.1	The API shall provide a method to activate or inhibit data acquisition at any gateway.	Thor(3) (Atlas)		FD Svcs + CMD	G/W Command
69.0		4.3.1.2	The API shall provide a method to activate or inhibit data processing at any gateway.	Thor(3) (Atlas)		FD Svcs + CMD	G/W Command
70.0		4.3.1.3	The API shall provide a method to activate or inhibit command issuance by any gateway.	Thor(3) (Atlas)		FD Svcs + CMD	G/W Command
71.0		4.3.1.7	The API shall provide a method to activate or inhibit data fusion processing at any DDP.	Thor(3) (Atlas)		DF	A global start/stop fusion?
73.0	2.2.9.3.	4.3.2.2	The API shall provide a method to read the data acquisition status of any gateway.	Thor(3) (Atlas)		SSI	
74.0	2.2.9.3.	4.3.2.3	The API shall provide a method to read the commanding status of any subsystem.	Thor(3) (Atlas)		SSI	
64.0	2.2.5.2.	4.2.4.4.3	The API shall provide a method for reading the current data stale indicator for an FD.	Thor(3) (Redstone)		FD Svcs	May be deleted (replaced by DH).
88.0		4.5.2.2	The API shall provide a method to specify and cancel event notification and an event handler for the arrival of a specific GMT.	Thor(3) (Redstone)		TS	
89.0		4.5.2.3	The API shall provide a method to specify and cancel event notification and an event handler for the arrival of a specific CDT or MET.	Thor(3) (Redstone)		TS	
96.0		4.5.2.10	The API shall provide a method to activate or inhibit all timer event notifications active for the application.	Thor(3) (Redstone)		TS	
7.0		4.1.5.1	Command blocked by a prerequisite sequence	Thor(2)		CMD	
79.0		4.4.1.6	The API shall provide a means for writing text strings to text objects in a user display window.	Thor* (Redstone)		"UDS, SL, platform"	String formatting
92.0		4.5.2.6	The API shall provide a method to periodically check for an event notification without the use of an event handler.	Thor* (Redstone)			Delete

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99.0		4.6.3	The API shall provide a method to specify application error routines which are called on the occurrence of user specified error conditions.	Thor* (Redstone)		EIM?	Error code executes in EIM; thro exceptions or trap signals & run routines; may delete & do in EIM.
20.0		4.2.1.10	The API shall provide a method for building a raw data word from an application software procedure.	Titan		OBS	For MDM BITE test 4; KSC-LPS-033-04 sec2.2
84.1		4.5.1.3.3	On board procedures (TCS scripts) via LDB	Titan			
115.0	2.1.1.1.2.7	4.10.1	Functionality shall be provided to command an Engine Interface Unit (EIU) to perform an internal function. The following functions shall be supported: (Reference KSC-LPS-OP-033-4 Section 3.2.1)	Titan		"OBS, CMD"	
116.0		4.10.1.1	· Status Override	Titan			
117.0		4.10.1.2	· Master Reset	Titan			
118.0		4.10.1.3	· Wrap Test	Titan			
125.0		4.10.3.1	· SIM PIC CAP Volt Enable	Titan			
128.0	?	4.10.4	Functionality shall be provided to request the Sequence Control Assembly (SCA) perform an internal function. The following functions shall be supported: : (Reference KSC-LPS-OP-033-4 Section 3.2.5)	Titan		"OBS, CMD"	
129.0		4.10.4.1	· Wrap Test	Titan			
130.0		4.10.4.2	· BITE Status Register	Titan			
131.0	2.1.1.5.1	4.10.5	Functionality shall be provided to request theuplink gateway to perform a specified function. The following options shall be supported: : (Reference KSC-LPS-OP-033-4 Section 3.2.6)	Titan		"OBS, CMD"	
132.0		4.10.5.1	· Two Stage Buffer Execute	Titan			
133.0		4.10.5.2	· Two Stage Buffer Clear	Titan			
134.0		4.10.5.3	· TO Issue	Titan			
136.0	2.1.1.1.2.7	4.10.6.1	· Engine Interface Unit	Titan			
140.0	2.1.1.1.2.?	4.10.6.5	· Sequence Control	Titan			

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142.0	2.1.1.1.5	4.10.8	"Functionality shall be provided to read the contents of GPC memory, DEU memory or SSME memory and store the data in a procedure variable. (Reference KSC-LPS-OP-033-4 Section 8.2) "	Titan		"OBS, CMD"	
143.0	2.1.1.1.5	4.10.9	Functionality shall be provided to modify locations in the GPC or SSME memory. (Reference KSC-LPS-OP-033-4 Section 8.3)	Titan		"OBS, CMD"	
144.0	2.1.1.1.4	4.10.10	Functionality shall be provided to modify the value of data contained in the TCS 1-1 registers without being required to specify the register's address. (Reference KSC-LPS-OP-033-4 Section 9.0)	Titan		"OBS, CMD"	
145.0	2.1.1.1.4	4.10.11	Functionality shall be provided to send values contained in the TCS 1-1 registers to the ground without being required to specify the register's address. (Reference KSC-LPS-OP-033-4 Section 10.0)	Titan		"OBS, CMD"	
146.0	2.1.1.1.2.11	4.10.12	Functionality shall be provided to specify the value of a DEU type command and issue it to the DEU. (Reference KSC-LPS-OP-033-4 Sections 11.1 and 11.2)	Titan		"OBS, CMD"	
147.0	2.1.1.1.2.11	4.10.13	Functionality shall be provided to allow a ground software procedure to display data to the on-board DEU CRT. (Reference KSC-LPS-OP-033-4 Section 11.3)	Titan		"OBS, CMD"	
148.0	2.1.1.1.2.9	4.10.14	Functionality shall be provided to issue commands to the KU-Band Communications Radar or to payload systems that have Payload Signal Processors / Payload Interrogator (PSP/PI) or other special IO device interfaces and to issue commands to the Spacelab s..	Titan		"OBS, CMD"	
149.0	2.1.1.1.2.8	4.10.15	Functionality shall be provided to command the Payload Data Interleaver (PDI) to perform the PDI Wrap Test. (Reference KSC-LPS-OP-033-4 Section 14.2)	Titan			

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Appendix A - APIs

API Index	SLS Rqmt#	User Apps Doc Rqmt #	Requirement	Delivery Needed (post-CIT)	ASV DP2 Rqmt #	CSCI / CSC	What is really needed?
150.0	2.1.1.1.2.8	4.10.16	Functionality shall be provided to read data from the PDI. (Reference KSC-LPS-OP-033-4 Section 14.3))	Titan		"OBS, CMD"	
151.0	2.1.1.5.1	4.10.17	Functionality shall be provided to issue CIE data and/or commands to the PCM uplink gateway for 128 KBS forward link command issuance. (Reference KSC-LPS-OP-033-4 Section 14.4)	Titan		"OBS, CMD"	
172.0	"2.1.1.1.4.2, 2.1.1.1.4.6 "	4.11.1	Functionality shall be provided to cancel or terminate the execution of an on-board explicitly coded program (ECP) or TCS sequence. (Reference KSC-LPS-OP-033-4 Section 4.1)	Titan		"OBS, CMD"	
173.0		4.11.2	Functionality shall be provided to initiate the parallel execution of a TCS sequence or ECP in the GPC which is currently communicating with the ground via the LDB. (Reference KSC-LPS-OP-033-4 Section 4.2)	Titan		"OBS, CMD"	
174.0	"2.1.1.1.4.2, 2.1.1.1.4.6, 2.1.1.1.4.7"	4.11.3	Functionality shall be provided to initiate the execution of a TCS Sequence. (Reference KSC-LPS-OP-033-4 Section 4.3)	Titan		"OBS, CMD"	
175.0	2.1.1.1.4.6	4.11.4	"Functionality shall be provided to temporarily halt the execution of a TCS sequence, to stop the execution of a repeated MDM single command in the PCM uplink gateway or to stop the execution of a repeated payload throughput command in the PCM uplink g"	Titan		"OBS, CMD"	
176.0	2.1.1.1.4.7	4.11.5	Functionality shall be provided to restart execution of a previously stopped TCS sequence. The capability shall provide an option to specify which TCS step number is to be used to re-start execution. (Reference KSC-LPS-OP-033-4 Section 4.4)	Titan		"OBS, CMD"	
177.0		4.12	Functionality shall be provided to support the on-board compiler directive capabilities (Reference KSC-LPS-OP-033-4 Section __.)	Titan		"OBS, CMD"	

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178.0		4.12.1	Activate/Inhibit Responses	Titan		"OBS, CMD"	
179.0		4.12.2	Activate/Inhibit MEC read BITE	Titan		"OBS, CMD"	
180.0		4.12.3	Activate/Inhibit Read BITE	Titan		"OBS, CMD"	
152.0	2.1.1.1.1	4.10.18	Functionality shall be provided to send a request to the Launch Sequence Functional Destination for controlling the terminal count. The following options shall be supported: (Reference KSC-LPS-OP-033-4 Section 3.2.2)	Titan (Delta)		"OBS, CMD"	
153.0		4.10.18.1	· RS Auto Sequence Start	Titan (Delta)		"OBS, CMD"	
154.0		4.10.18.2	· Hold	Titan (Delta)		"OBS, CMD"	
155.0		4.10.18.3	· Recycle	Titan (Delta)		"OBS, CMD"	
156.0		4.10.18.4	· Bypass of LO2 Overboard Bleed Valve CL A	Titan (Delta)		"OBS, CMD"	
157.0		4.10.18.5	· Bypass of LO2 Overboard Bleed Valve CL B	Titan (Delta)		"OBS, CMD"	
158.0		4.10.18.6	· Bypass of LO2 Accumulator Recirculation Valve OP	Titan (Delta)		"OBS, CMD"	
159.0		4.10.18.7	· Resume Count	Titan (Delta)		"OBS, CMD"	
160.0		4.10.18.8	· SRB FCS Hydraulic Verification Flag	Titan (Delta)		"OBS, CMD"	
161.0		4.10.18.9	· Orbiter Vent Doors Override	Titan (Delta)		"OBS, CMD"	
162.0		4.10.18.10	· Estimated Mass of Orbiter with ET	Titan (Delta)		"OBS, CMD"	
163.0		4.10.18.11	· Aerosurface Drive Check	Titan (Delta)		"OBS, CMD"	
164.0		4.10.18.12	· MPS/ET Low Level Sensor Disable Flag	Titan (Delta)		"OBS, CMD"	
165.0		4.10.18.13	· MPS Gimbal Check	Titan (Delta)		"OBS, CMD"	
166.0		4.10.18.14	· MPS LOX Low Level Sensor Disable Flag	Titan (Delta)		"OBS, CMD"	
167.0		4.10.18.15	· LPS Go for Engine Start	Titan (Delta)		"OBS, CMD"	
168.0		4.10.18.16	· ET LH2 Low Level Sensor Disable Flag	Titan (Delta)		"OBS, CMD"	

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169.0		4.10.18.17	· SRM Chamber Pressure Calibration Word	Titan (Delta)		"OBS, CMD"	
170.0		4.10.18.18	· JTOY of Lift OFF TO	Titan (Delta)		"OBS, CMD"	
21.0		4.2.1.11	The API shall provide a method for converting a raw data word into measurement data. (Reference KSC-LPS-OP-033-04 Section 2.1)	Titan (NewRqmt)		OBS	
49.4		4.2.4.3.5	The API shall provide a method for changing the RSYS for an FD.				
83.0		4.5.1.3	The API shall provide a means for executing concurrent applications and scripts including:				
			* - asterisk indicates a requirement by HMF				